

LISTING OF CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (original) A diagnostic method, comprising:

estimating a temperature of a NOx-reducing catalyst based on a thermodynamic model of said NOx-reducing catalyst;

estimating a hydrocarbon conversion efficiency of said NOx-reducing catalyst based on said temperature estimate; and

estimating a parameter indicative of an age of said NOx-reducing catalyst based on said estimated hydrocarbon conversion efficiency of said catalyst.

2. (original) The method as set forth in Claim 1 wherein said thermodynamic model of said NOx-reducing catalyst is described by the following equations:

$$\frac{d}{dt}(c_{\text{substrate}}m_{\text{cat}}T + c_{\text{gas}}m_{\text{gas}}T) = c_p W(T_{\text{in}} - T) + h_i A_{\text{cat}}(T_{\text{amb}} - T) + (W_{\text{HC}} \cdot f_{\text{burn}}(T) + f_{\text{red}}(T) \cdot \text{HC}_{\text{in}}) \cdot Q_{\text{L}} \quad (1)$$

$$\frac{d}{dt} \text{HC}_{\text{in}} = (1 - f_{\text{burn}}(T)) \cdot W_{\text{HC}} - f_{\text{red}}(T) \cdot \text{HC}_{\text{in}} \quad (2)$$

wherein  $c_{\text{substrate}}$  is a heat capacity of a NOx-reducing catalyst substrate,  $m_{\text{cat}}$  is a mass of said catalyst,  $c_{\text{gas}}$  is a heat capacity of the exhaust gas,  $m_{\text{gas}}$  is a mass of the exhaust gas in the catalyst,  $c_p$  is a heat capacity of air at constant pressure,  $W$  is a total exhaust flow into said catalyst,  $T_{\text{in}}$  is a temperature of an exhaust gas mixture entering said NOx-reducing catalyst,  $h_i$  is a convective heat transfer coefficient of said catalyst,  $A_{\text{cat}}$  is a catalyst area exposed to said exhaust gas mixture entering said catalyst,  $T_{\text{amb}}$  is an ambient temperature,  $W_{\text{HC}}$  is a hydrocarbon flow transported in said exhaust gas mixture,  $f_{\text{burn}}(T)$  is said hydrocarbon conversion efficiency of said

catalyst,  $Q_{th}$  is a heat contained in a unit mass of fuel,  $f_{rel}(T)$  is an amount of hydrocarbons released and subsequently oxidized, and  $HC_s$  is an amount of hydrocarbons stored in the catalyst.

3. (original)The method as set forth in Claim 2 wherein said hydrocarbon conversion efficiency of said NOx-reducing catalyst is estimated by inverting said model in order to obtain an input from an output.
4. (original)The method as set forth in Claim 1 wherein said NOx-reducing catalyst is an ALNC.
5. (original)The method as set forth in Claim 1 wherein said NOx-reducing catalyst is an oxidation catalyst.
6. (original)The method as set forth in Claim 1 further comprising providing an indication of catalyst degradation based on said parameter.

7-16. Cancelled.

17. (original)A diagnostic system, comprising:
  - an internal combustion engine;
  - a NOx-reducing catalyst coupled downstream of said engine;
  - and
  - a computer storage medium having a computer program encoded therein, comprising:
    - code for estimating a temperature of said NOx-reducing catalyst based on a thermodynamic model of said NOx-reducing catalyst;
    - code for estimating a hydrocarbon conversion efficiency of said NOx-reducing catalyst based on said temperature estimate; and

code for estimating a parameter indicative of an age of  
said NOx-reducing catalyst based on said estimated  
hydrocarbon conversion efficiency of said  
catalyst.